METHODS OF BUSINESS FORECASTING BASED ON FUNDAMENTAL STATISTICS

A business man succeeds or fails in proportion to his ability to forecast the future trend of the influences determining the relation of supply and demand in his business. Some of these influences are technical and concern his particular business without affecting other lines; others are of a general nature and affect all lines of business definitely and vitally.

Some men form their judgment of these fundamental business factors from reading newspapers and trade journals. Others arrive at their opinion of the trend of affairs by observing the changes in statistics of trade and finance. Still others, going further, have made graphic charts based upon statistics of fundamental conditions, and have attempted from these graphic pictures of the past history of business to deduce laws of trade in accordance with which the future of business may be foretold. It is our purpose here to discuss the different methods of forecasting which have been based upon these various mechanical illustrations of the trend of business conditions.

Of those students of economic conditions who have attempted to develop a method of forecasting business conditions I have selected four for discussion. Two of these, namely, Stanley Jevons, the English economist, and Samuel Benner, an Ohio farmer, published the results of their investigations about thirty years ago.[1] A third, Mr. Roger W. Babson, of Massachusetts, has published the results of his studies within the past three years. The fourth is the economist, Professor Irving Fisher, of Yale University, whose first forecast appeared in the June number of the AMERICAN ECONOMIC REVIEW for 1911.

According to the method used these business forecasters may be divided into two classes: first, those who construct a chart or diagram and let it do the forecasting; and, second, those who use the cartographical device merely as a basis to judge the trend of

[1] The juxtaposition of the names Jevons and Benner may seem rather incongruous. In extenuation it may be said that Benner deserves to be given prominence as the pioneer in the work of systematically forecasting business conditions in this country. Furthermore, while his writings received little if any recognition among economists, he had for a time a considerable following among business men. His methods, although crude, are not without points of resemblance to some at present in use.

conditions and attempt in addition to diagnose the future outlook of such factors as crops and politics before making a forecast. Under the first method there is no need of considering anything but the chart, for whether we have good crops and settled politics or crop failure and political discontent, it is supposed to forecast prosperity or depression with the scientific precision with which we can predict that spring and summer will be followed by fall and winter. Under the second method, however, the chart or diagram is insufficient as a forecaster. Human judgment is an additional requirement.

Of the four students mentioned, three, Jevons, Benner, and Babson, forecast by the first method, that is, the charts do the forecasting for them. Professor Fisher's diagram, however, gives a picture of past conditions and shows the trend of affairs, but does not imply an inevitable tendency for the future.

As to which method is the better, "the proof of the pudding is in the eating." I will therefore take up the work of each student of the subject in order and show what he has attempted to do, the method used, and the success attained. Before making a practical test of each case, however, I would postulate that no method of forecasting business conditions can be efficient or benefit the commercial world which does not take account of the three fundamental factors of primary importance, namely, crops, politics, and the condition of banking credit.

The purpose of the investigations of Jevons was to show that commercial crises were periodic, being caused by periodic changes in the solar influences which determine weather conditions. As weather conditions determine the yield of the harvests, and since a failure of the crops always causes depression in business, all that was necessary to prove the periodicity of commercial crises, thought Jevons, was to demonstrate the periodicity of the weather conditions which cause deficient harvests. Believing that he had found something in meteorological theories to help him, he conducted a series of investigations based on the hypothesis that the periodocity of commercial crises was caused by periodic variations in the frequency of the sun-spots. Probably a reason for making this supposition was that contemporary astronomers had concluded that the duration of a sun-spot period was about ten or eleven years, which corresponded strikingly with the interval between commercial crises in England.
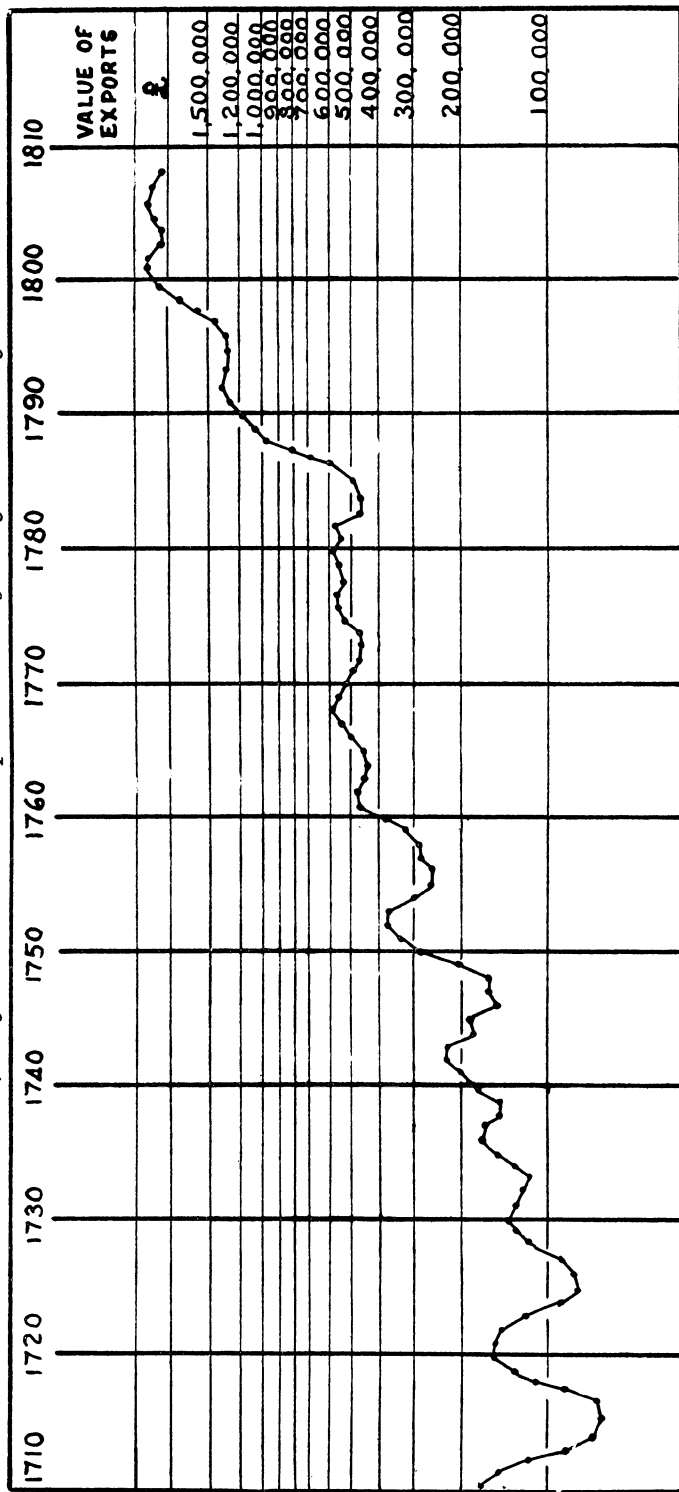
In support of his hypothesis Jevons in 1878 published

graphic charts of the statistics of exports from Great Britain to India and several American states, the most interesting of which was a diagram (see Chart A) showing a rythmic fluctuation in the amount of English goods exported to India covering a period of one hundred and seventy years, and which showed a low ebb in foreign trade on an average of once in ten years. These cycles in exports were due to the periodic variations in tropical harvests, for when the harvests failed, the famine-stricken ryot of India could not buy the textiles of Lancashire. The result of the consequent falling off in exports was a commercial crisis in England, entailing numerous bankruptcies, and followed by a period of depression, which continued until the harvests of India again furnished a surplus which could be exchanged for English goods. These periodic variations in tropical harvests, Jevons professed to believe, corresponded with the solar periods.

But while these charts showed periodic effects, there is no conclusive evidence as to the cause, for the conclusions of the astronomers regarding sun-spot cycles have not yet approximated scientific laws, but are merely hypotheses, and therefore of no certain utility as a basis for predicting when we shall have crop failures. The chart of Jevons, moreover, showed that there were no distinctive periodic fluctuations in the exports to non-tropical countries, such as the New England states, so that the efforts of Jevons to deduce laws of trade from a chart which would serve as a mechanical forecaster of business conditions were not successful, and it may be added that further economic investigations seeking to correlate commercial conditions with solar influences must be deferred until astronomers can tell us more about the sun. It is a peculiar fact, however, that although nothing conclusive has ever been established regarding the periodicity of panics, many economists of scientific standing have clung to Jevons' hypothesis of ten-year cycles as if it were a law, although really it is nothing more than a superstition as unfounded as the notion that thirteen is an unlucky number.

But even if Jevons had been successful in establishing a law of periodicity in commercial crises, it would not serve as an adequate basis for forecasting business in the United States, because, as stated above, any efficient method of forecasting business must take account of crops, politics, and banking conditions; and Jevons considered only crops. It is hardly fair to criticise Jevons on this score, however, as he was interested merely in tracing the origin

CHART A.

Jevons' chart of English merchandise exports, showing ten-year trade cycles.

VALUE OF EXPORTS		1810	1800	1790	1780	1770	1760	1750	1740	1730	1720	1710
£												
1,500,000												
1,200,000												
1,000,000												
900,000												
800,000												
700,000												
600,000												
500,000												
400,000												
300,000												
200,000												
100,000												

of commercial crises to planetary causes, and did not attempt to develop a system of forecasting business from year to year.
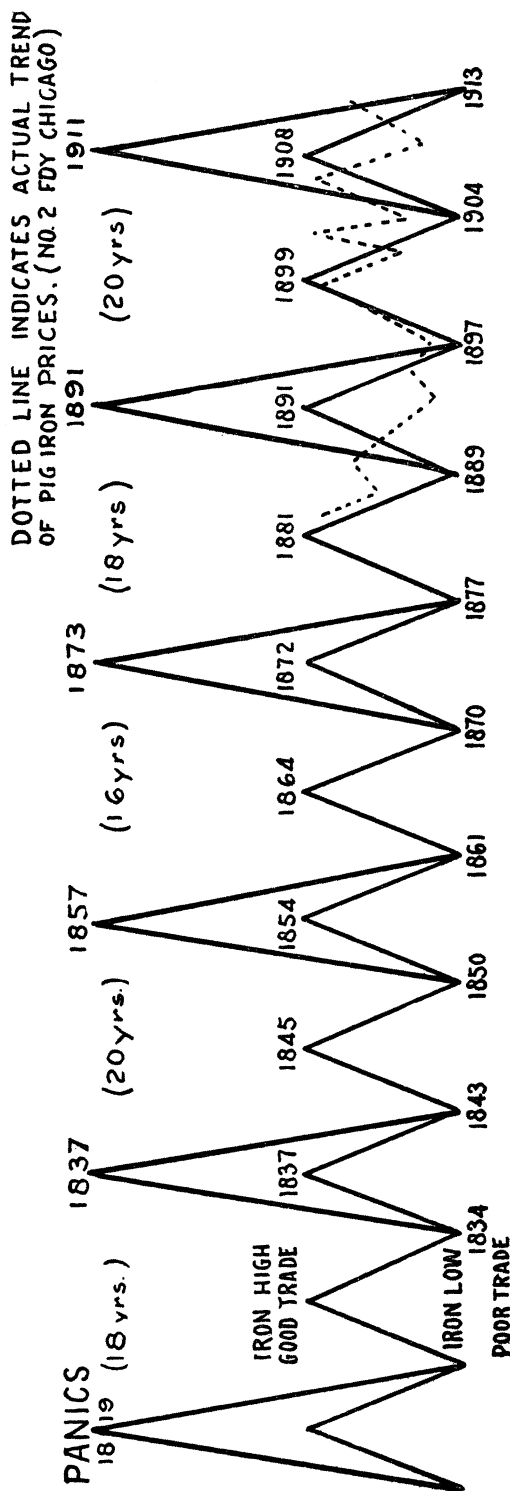
Benner, however, formulated an hypothesis from which he believed it possible to forecast panics and cycles of "ups and downs" in prices with certainty, and though confessing ignorance of the causes determining these cycles, he assumed that their periodic appearance could be expected "with as much certainty and astronomical exactness as the return of the eclipses of the sun and moon." His theory of price cycles was stated in his so-called "Cast Iron Rule," which was that "one extreme invariably follows another in all the operations of nature, in all the business affairs of man, and in all the ramifications of trade and industry." This rule when applied to the fluctuations of prices through a series of years he considered "as persistent as the attractive and repulsive forces of the magnet, and as unchangeable as the laws of the Medes and Persians."

In verification of this theory of price cycles Benner published several diagrams, the most important of which was a diagram of the ups and downs in pig iron prices (see Chart B), showing that from 1837 to 1888 pig iron cycles occurred at successive periods of eight, nine, and ten years, and also that in broad cycles of fifty-four years there were panics returning in successive periods of sixteen, eighteen, and twenty years. According to this diagram panics were to occur in 1891, 1911, 1918, etc., but as it turned out they occurred in 1893 and 1907. Pig iron cycles should have culminated in 1891, 1899, 1908, etc., but in all these years except one pig iron prices were very low, and several points have been reached in the course of pig iron prices which did not correspond to Mr. Benner's "Cast Iron Rule" as illustrated by his diagram. It is evident, therefore, that his attempt to produce a chart which would forecast business conditions was unsatisfactory, and his method unworkable.

I would say, however, that in attaching importance to price cycles Mr. Benner was on the right track, and his work is highly suggestive, but he did not seem to have a clear understanding of what are called fundamental conditions. Though a keen observer, he did not discern the causes which produced the conditions of alternating prosperity and depression. He believed a high tariff together with greenbacks and a free silver currency to be necessary to prosperity, and the converse the cause of depression, while we know that the fear of cheap money legislation

CHART B.

Benner's cycles of pig iron prices, showing periodic ups and downs in business.

DOTTED LINE INDICATES ACTUAL TREND
OF PIG IRON PRICES. (NO. 2 FDY CHICAGO)

PANICS
18 19 (18 yrs.)

IRON HIGH
GOOD TRADE

IRON LOW
POOR TRADE

1837 (20 yrs.) 1857 (16 yrs.) 1873 (18 yrs.) 1891 (20 yrs.) 1911

1837 1845 1854 1864 1872 1881 1891 1899 1908 1913

1834 1843 1850 1861 1870 1877 1889 1897 1904

caused the panic of 1893, and a collapse of banking credit the panic of 1907. In spite of his crude notions about the influences determining business conditions, however, Mr. Benner's *Book of Prophecies,* published in 1875 and in later revised editions, did much toward the advancement of the study of fundamental conditions and deservedly attracted a great deal of attention among business men.

In the last edition of his *Prophecies,* published in 1900, Mr. Benner concluded his forecast with the remark that he had been in poor health for some time—"the spirit of prophecy had nearly departed"—and hoped that "some enthusiastic and ambitious person would take up the subject of Benner's *Book of Prophecies,* bring the tables and prices up to date, and extend the cycles into the far future." The number of forecasters now in the field bears witness that his prayer has been answered. In fact, the "Theory of Action and Reaction" which Mr. Babson professes as the basis of his method of forecasting business, is the same idea, in the terminology of physics, as Mr. Benner's "Cast Iron Rule" that "one extreme invariably follows another." Mr. Babson goes one step further than Mr. Benner, however, and says that "action and reaction are equal," considering not merely the intensity of each extreme but also the time of action. To illustrate this theory, he plots statistics of business and financial factors above and below a line which represents the normal growth of the country's business (see Chart C), and says that the area within the graph above the line must equal the area below the line, that is, the "areas of prosperity and depression must be equal."

Now, this theory of action and reaction is scientifically correct for past periods for which the normal growth can be calculated from statistical data, for the reason that the line of "normal growth" is itself really an average of past business conditions. It might also be true of the future if there were no change in the normal increase of the volume of business. There are two factors, however, which may prevent new "areas" from being formed as might be expected from the trend of past areas and line of normal growth. These factors are politics and crops. For politics may so depress business and thus intensify and prolong the area below the normal line of growth that it will much more than equal the preceding area of prosperity above the line. This situation would doubtless be found in the period of depression from 1892 to 1897, if the area formed during this period were constructed below the

Chart C.—*Babson's area plot, showing periods of prosperity an d depression.*

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912

A B C D E
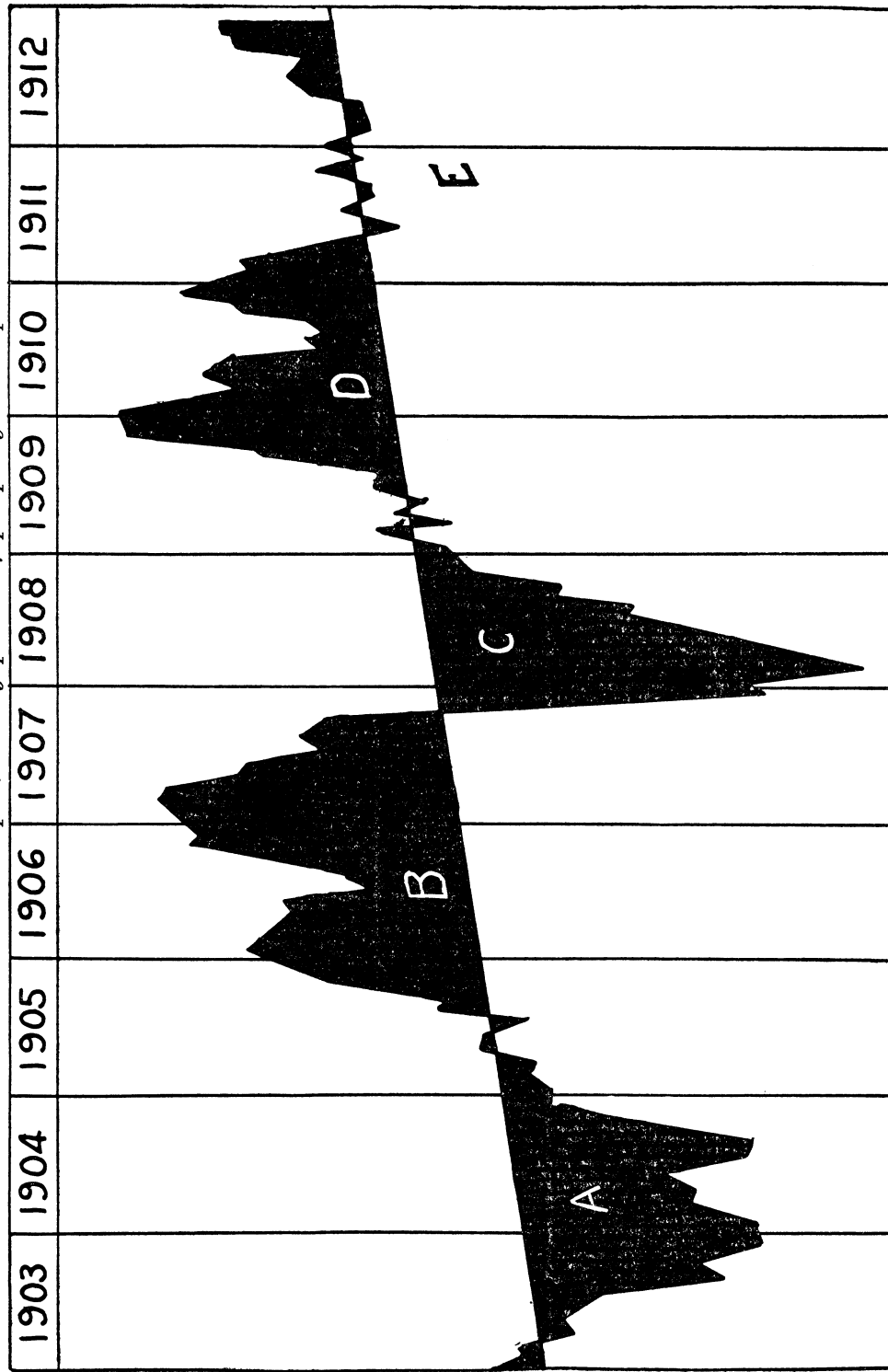
line of growth for the ten years preceding. Similarly, crop failures may also continue a depressed area. But a good harvest or a succession of good crops may come just when the area of prosperity above the line is vanishing, and this would check the downward tendency of the area below the line so that it would not equal the preceding area above the line. In fact, according to the theory that action and reaction are equal, an area below the line should have developed during the latter part of 1911 and the year 1912, but as a matter of history this area has not materialized as the theory requires. This the author explains by saying that "owing to the increased study of fundamental conditions these areas should slowly decrease in size," the area now to be developed below the line being smaller than the preceding area above the line. This explanation, of course, virtually rejects the theory that action and reaction must be equal, and intimates that like the swings of a pendulum, the areas above and below the line will grow smaller with each oscillation. And since we believe that the principle of equality of action and reaction is true, as applied to past conditions where it is mathematically possible to make allowances for abnormal crop and political tendencies, we are inclined to believe that the inherent defect in the area plot lies in the impossibility of accurately predetermining the line of normal growth. All students of the subject recognize the fact that this line changes from year to year and that it is therefore subject to revision, but this necessity of constant revision of the line of normal growth vitiates the worth of the area plot as a device intended to serve as a mechanical forecaster of business conditions, for obviously the newest area will not equal the area preceding until the plot is reconstructed. Therefore, instead of being a machine which will forecast conditions, it serves only as a picture of past conditions. As such, it can be used to some extent as a basis of judging the future, if separate cognizance is taken of the crop and political outlook at all times, but this use is extremely limited because during a period of prosperity there is nothing in the area plot which will tell when a panic or period of liquidation may be expected. For in order to forecast a reaction in business, it is necessary to have an accurate knowledge of the condition of banking credit, and although banking factors are included in the area plot, they are averaged in with the business factors so that their especial value as a business barometer is obscured.

Recapitulating, the theory of action and reaction is true of past conditions, but neither this theory nor the area plot will serve as a mechanical business forecaster complete in and of itself. And although the area plot, properly constructed, would have some value as a basis of judging the trend of affairs if the outlook for crops and politics be considered separately, still its use in forecasting is extremely limited, since it does not give us an accurate knowledge of banking conditions, the most important of all fundamentals in any method of forecasting.

In contrast with the three preceding students who have attempted to forecast business conditions by the use of charted statistics, the work of Professor Irving Fisher differs both as to method and factors used. It will be remembered that Jevons sought to correlate commercial crises with the fixed tendencies of solar influences, that Benner sought to show that panics were periodic, and that Babson, while forswearing temporal periodicity, professes to believe in periodicity in plotted areas. In each case the future had to conform to the past trend of the chart or diagram. The diagram illustrating Professor Fisher's "Equation of Exchange," however, is used, not as a mechanical forecaster in and of itself, but merely as a picture of past and present conditions. The future is not indicated, but must be judged from the general outlook, using the diagram as a guide. Not only in method, but also with regard to the factors used does Fisher differ from others, for while statistics of foreign trade were charted by Jevons, pig iron prices by Benner, and financial and trade statistics by Babson, Fisher depends mainly upon banking statistics.

In discussing his "Equation of Exchange," however, it must be said that he, like Jevons, was not primarily interested in developing a method of forecasting business, but devised his diagram to illustrate the quantity theory of money.[2]

In his "Equation" Fisher has with approximate accuracy discovered the velocity of circulation of money, the first time in history that this achievement has been accomplished. The feature which serves as a basis of forecasting, however, is the velocity of

[2] The Equation of Exchange is
$$M V + M' V' = P T.$$
M and M' represent respectively the amount of money and checkable deposits in the country, V and V' respectively representing the velocity of circulation of money and checks. P stands for the price level and T for the volume of trade. (See *Purchasing Power of Money*, p. 48.)

check circulation, or the rate at which checks are passed from hand
to hand. The French economist Des Essars says that the great-
est velocity of checkable deposits is attained in the year the crisis
arrives. Professor Fisher says his estimates for this country
show the greatest velocity at least a year before the crisis, the
maximum velocity having been reached in 1899, 1901, 1906, and
1909, in each case preceding the year in which prosperity cul-
minated.

It seems to be pretty well established that the velocity of de-
posit currency increases during business improvement and de-
creases during industrial depression, so that theoretically it should
prove a good barometer of business conditions. The chief impedi-
ment to its use as such heretofore has been the absence of accu-
rate statistics. In fact, Fisher's figures for velocities between 1896
and 1909 are interpolations, there being no data in existence from
which computations could be made. Moreover, a chart of Fisher's
estimates of the velocity of check circulation, the normal growth
having been eliminated, shows that there is no dependable ten-
dency from which the degree of normality of conditions can be
judged (see Chart D). It would appear, therefore, assuming
that the activity of deposits is a good barometer, that the chief
defect in the "Equation of Exchange," from the standpoint of
business forecasting, lies in the fact that it has been necessary to
base calculations of the velocities of deposit currency upon sta-
tistics which are admittedly far from accurate. Before the "Equa-
tion of Exchange" can become serviceable to the business world
as an aid in forecasting the trend of conditions, it will be necessary
that the statistical data be obtained more accurately, as well as
more frequently, than the present yearly estimates.

From the foregoing it is evident that the attempts to produce a
chart which would serve as a mechanical forecaster of business
conditions have been unsuccessful, and rationally such a result
should be expected, for the ups and downs in business do not
return with the regularity of the changes of the seasons, and
therefore cannot be forecasted years ahead of time, except con-
ditionally. The role of the successful business forecaster must be
analogous to that of the weather forecaster, who finds a depend-
able basis for his work in the planetary movements which deter-
mine the seasons of the year, but whose immediate forecasts of
snow, rain, heat, and cold must be based upon conditions actually
existing in other sections of the terrestial atmosphere, and qual-

Chart D.—*Fisher's estimates of the velocity of circulation of bank checks.*
(Normal Growth (2%) eliminated.)
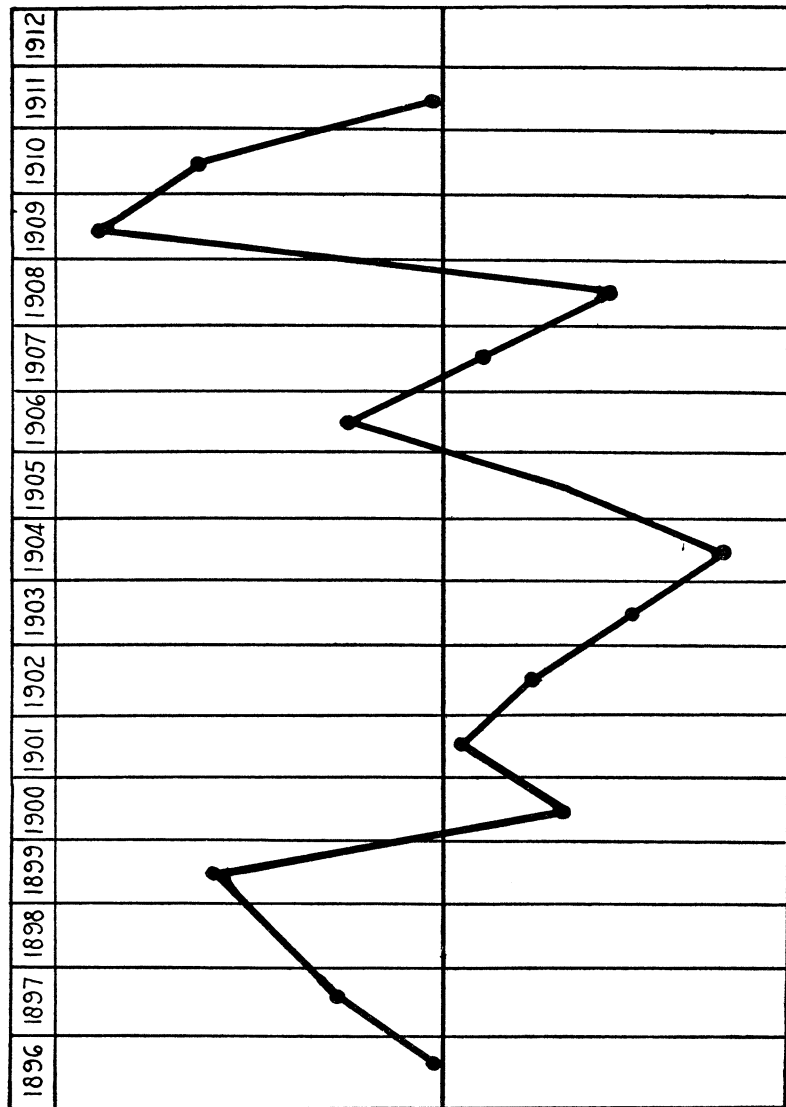
Velocity of Check Circulation.

Year	Actual	Normal growth eliminated
1896	37.	37.
1897	39.	38.2
1898	40.5	38.9
1899	42.	39.6
1900	38.5	35.6
1901	40.5	36.7
1902	40.5	36.0
1903	40.	34.8
1904	39.5	33.7
1905	42.5	35.6
1906	46.5	38.1
1907	45.5	36.6
1908	44.5	35.1
1909	53.	41.0
1910	52.5	39.8
1911	50.	37.1

NOTE.—Actual figures for velocity are those shown in **Prof. Irving Fisher's** "Equation of Exchange."

| 1896 | 1897 | 1898 | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 |

ified with regard to the direction of the wind. If there is a sudden shifting of the wind, the forecast must accordingly be modified. Similarly, the business forecaster can predicate his forecasts upon the general trend of fundamental conditions, but his forecasts, like those of the weather man, must be based on conditions actually existing, particularly in the money market, and conditioned as to the future political and crop outlook. With any change in the political, crop, or international money outlook, the forecast must be modified accordingly.

As a guide to judging future business conditions according to the above method, I have constructed a "Composite Chart of Fundamentals" (see Chart E). This chart comprises a business graph, a banking graph, and a graph to show the trend of thirty-two leading stocks.

In constructing these graphs each factor included has been tested separately and only those have been chosen which are good barometers in themselves. The business graph reflects an average of the monthly statistics of bank clearings, railroad earnings, pig iron production and prices, commodity prices, imports, building, and immigration. The factors used in the banking graph are reserves, deposits, the rate of commercial paper, the percentage of loans to deposits, and the percentage of reserves to loans.

It is absolutely necessary to obtain barometer figures for each factor separately before combining all factors, because some factors manifest a seasonal variation which must be eliminated, while others show a normal growth which must be reduced to a normal after determining upon a base year. Thus, bank clearings, railroad earnings, and pig iron production vary from month to month and show an increasing tendency over a period of years; money rates show a seasonal variation but no normal growth to speak of; while pig iron prices are a very good single barometer without eliminating either seasonal variation or normal growth. The great advantage of treating each factor separately is easily evident, for a sudden change in the growth of any one will make little difference when averaged with the rest, while in Mr. Babson's "Area Plot," the location of the whole area is changed by changing the single line of normal growth.

In the preliminary work of developing the "Composite Chart of Fundamentals" several factors other than those above mentioned were tentatively included and then rejected, such as the statistics for idle cars and for copper production and prices. But in case

of idle cars the number is such a small proportion of the total
number of cars in the country that the statistics of idle cars alone
show fluctuations too violent to be used as a dependable barometer.
On the other hand, copper prices are a sensitive and reliable
barometer of industrial conditions, but the fact that one half the
copper produced in this country is exported makes it inadvisable
to include copper statistics in the business graph, for during
a period of dull business in this country a spurt in the foreign de-
mand for copper may cause a rise to prosperity prices. This
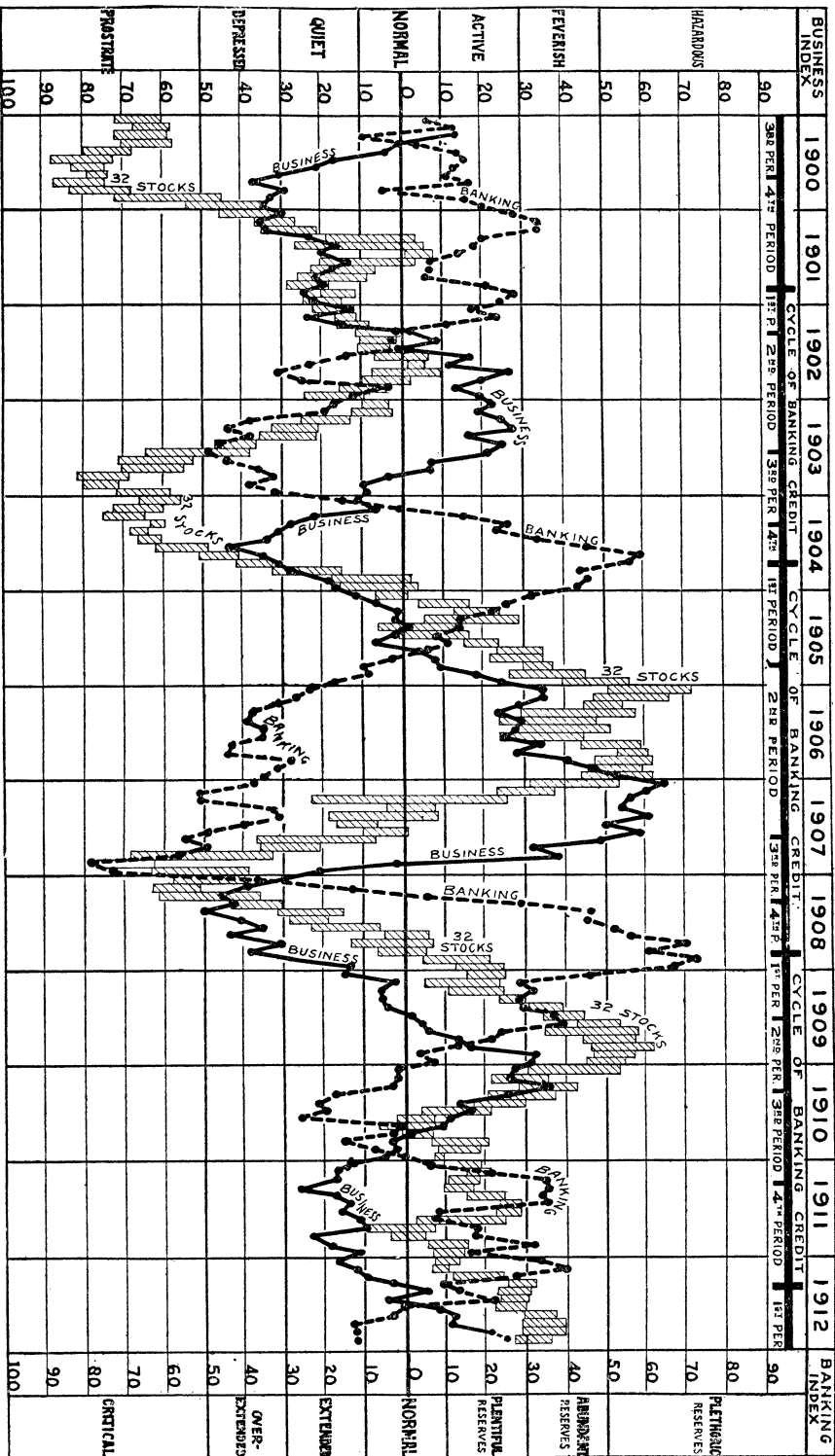is what happened during the first half of 1912.

By dividing the composite chart into periods or cycles, which
are well defined, its utility as a basis of forecasting is enhanced,
and since the crisis which marks the culmination of each cycle is
generally caused by the collapse of our credit system, these
periodic divisions of the chart may be called "Cycles of Bank-
ing Credit." These cycles usually last about four years, due to
the fact that business generally halts until the result of the presi-
dential election can be ascertained, and after expanding for two
or three years suffers a reaction because banking credit becomes
over-extended and collapses, owing to vital but remediable defects
in our banking system, chief of which is the lack of a central
bank to control the minimum discount rate of the country, for, as
Professor Irving Fisher, in his *Purchasing Power of Money*, has so
strongly enunciated, "the incubation period of a crisis is largely
due to the sluggishness with which the rate of interest adjusts
itself to changes in prices, coupled with the fact that this in-
adequacy in the adjustment of the rate of interest itself stimulates
and aggravates the rise in prices." After business has thus been
checked, a new period of expansion is generally deferred until
after the next presidential election. It is evident that the duration
of these cycles is not a constant quantity, as would be a cycle
determined by astronomical causes, for a thorough reform of our
banking system and a change in the length of the presidential
term would doubtless lengthen the credit period and bring about
a notable change in the effect of political influences upon business.

During each credit cycle business conditions pass through four
stages or periods as follows: (1) Improvement; (2) Prosperity;
(3) Liquidation; (4) Readjustment.

In order to have a period of business improvement three favor-
able fundamental conditions are required, namely, good crops,
satisfactory politics, and easy money conditions. A rise in the

CHART E.

Brookmire's composite chart of business, banking, and investment conditions, showing cycles of banking credit.

| BUSINESS INDEX | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | BANKING INDEX |

stock market for three or four months always precedes and forecasts business improvement.   The business man will find the stock
market a reliable barometer, because its movements at all times
reflect the best judgment of the world's most far-sighted financiers regarding the business outlook.   Accordingly, when a rise
in the level of security prices foretells improvement, the merchant
or manufacturer may plan to push his sales and increase his
stock of goods with confidence, for a period of improvement is
accompanied by rising prices of nearly all goods, and the earlier
preparation is made, the greater will be the profits.   The question
naturally suggests itself, however, When is the business man to
be warned of the culmination of the period of prosperity which
follows the period of improvement?   The answer is that the banking graph is a very reliable barometer, for during the period
of prosperity the banking graph falls, indicating that the resources of the banks are being drained off into the avenues of
commerce.   When the banking graph indicates that the reserves
are as low as the law allows, the banks call the loans of such of their
customers as have borrowed money on call to buy securities, thus
forcing security liquidation.   The money which the banks thus
obtain is loaned to merchants and manufacturers.   But during the
forced sale of securities which attends this transfer of funds from
stock exchange borrowers to the commercial demand, security
prices are lowered ruinously, and the stock market graph rapidly
falls, and here again the business man will find his best friend in
the stock market graph.   For when the banks have reached the
limit of security selling, and can no longer obtain money in this
direction, there is no alternative but to refuse to renew the loans
of commercial borrowers.   The result is that merchants sell their
goods at sacrifice prices to pay up at the banks, and there is general liquidation throughout the entire business world.   As indicated above, however, this situation is always forecasted by the fall
in the banking and stock market graphs, the stock market especially being an invaluable barometer to the business man in
warning him of a period of declining prices and business reaction.
Following the period of liquidation comes the period of readjustment, and the cycle is complete when a rise in the stock market
portends the period of improvement of a new cycle.

<div align="right">JAMES H. BROOKMIRE.</div>

St. Louis.